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ABSTRACT

This paper presents the results of research conducted to develop a model or a conceptual framework fo the study of project management in the field of educational research and development. The basic framework incorporates two dimensions; (1) the project and (2) its environment. Four project components; task, temporary management system, project manager, and project success/criteria -- are identified. The environment component is comprised of the influences on the project originating from the parent organization, the customer and the market, and the general cultural conditions surrounding the project (economic, social, political, and technological). (Author)

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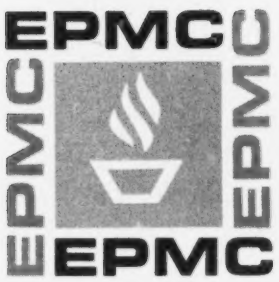

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A CONCEPTUAL FRAMEWORK FOR THE STUDY OF PROJECT MANAGEMENT IN EDUCATION

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Final Report

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The ideas presented in this report are those alone of the author and he bears full responsibility for them.

A CONCEPTUAL FRAMEWORK FOR THE STUDY OF PROJECT MANAGEMENT IN EDUCATION

Desmond L. Cook*

ABSTRACT

This paper presents the results of research conducted during the past year under a grant from the Research Committee of the College of Education, The Ohio State University, to develop a model or conceptual framework for the study of project management in the field of educational research and development activities.

The basic framework has two dimensions--the project and its environment. Within the project, four components--task, temporary management system, project manager, and project success/criteria--are identified and discussed. The environment component consists of influences upon the project originating from the parent organization, the customer and market, and the general cultural conditions (economic, social, political, and technological) surrounding the project.

INTRODUCTION

Background

Since the early 1960's, the author has developed an interest in the general problems of and procedures of the management of research, development, diffusion, and evaluation (RDDE) activities in the field of education. An initial effort in this area was the study of the applicability of the Program Evaluation and Review Technique (PERT) to such types of activities under a development grant from the Bureau of Research, Office of Education, Department of Health, Education and Welfare (DHEW). The final report from this project was published in the form of a monograph describing the advantages and limitations of PERT for educational RDDE along with its general nature and features (17).

The Educational Program Management Center was established in 1966 by the College of Education to serve as a focal point for

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faculty, staff, and students who might be interested in the application of management and management science concepts and principles to educational research and development activities, particularly those of an innovative, once-through, change-oriented, or developmental nature. Most representative of these types of activities would be the various programs and projects supported through federal funding programs as represented by NDEA in 1958, the Vocational Education Act of 1963, and the Elementary and Secondary Education Act of 1965, and similar legislation.

Since its establishment, the Educational Program Management Center (EPMC) has carried out a variety of activities designed to advance the utilization of management concepts and principles in research and development (R and D) efforts. While concerned with the more general problems of R and D management, specific attention has been given to the emerging area of program/project management as it is employed in the field of education. The concern for improved project management has resulted in a variety of efforts designed to better understand and to train personnel in the basic ideas underlying the concept. Most notable of these efforts has been the conduct of two training programs for educational research personnel with the objective of developing management skills for use in research and development activities (26, 42). These two training efforts were carried out with support from the Research Training Branch of the Office of Education, DHEW. More recently, an analysis of the duties, responsibilities, and authority relationships of educational program and project managers was undertaken correlative with the conduct of project management training sessions in the educational accountability institutes conducted under the auspices of the Bureau of Elementary and Secondary Education, Office of Education, DHEW (16). The author of this paper has recently also published what is probably the only major book dealing with the concept of project management as it operates in the field of education (15). More recently the EPMC has undertaken to develop self-instructional packages designed to provide an orientation to project management for educational executives and to develop competency in the basic skills and concepts of project management for actual or potential educational project managers. The development of these two prototype packages has been funded by a contract with Research for Better Schools, Inc., a regional educational laboratory located in Philadelphia.

Purpose

It has become apparent during the course of these various activities that some form of structure was needed in order to organize and direct the development of both theory and practice in program/project management in education. The availability of a conceptual framework would provide emphasis to an integrative or systems approach to the study of program/project management as contrasted to a fragmented or isolated approach. The conceptual schema should identify the significant variables involved in the successful management of a program or project, along with the interrelationships between and among the variables. Any conceptualization would have to bear the scrutiny of being scientific in nature since it might well become the foundation for the theory and practice of project/program management. The absence of such a conceptual schema could well mean that research efforts might be essentially random in nature.

Recognition of this need for a conceptual base led to the development of a proposal outlining a proposed methodology for determining whether or not it was feasible to develop a model of project management.* Initial emphasis was given to the development of a mathematical model since it was deemed vital that any model developed would have to be eventually validated by collecting data and testing the relationship between variables wherein the latter had been expressed in some quantitative form. The generalized steps for the proposed developmental phases are presented below.

Phase I - Development of Model

The primary aim of Phase I would be to develop the basic framework of a model. Activities of concern here would be a review of the literature, talks with experts, and related activities in order to derive the significant sets and subsets of variables making up the larget set. Concern here would also be with whether or not a linear model is appropriate, whether regression analysis is appropriate, and similar kinds of questions. The end product of this phase would be a tentative statement of the model.

*For convenience, the term project management will be used to cover the related concepts of program and systems management. Such a usage is consistent with current writing in the field of business, industry, and the military.

Phase II - Validation of Model

The primary activity of this phase would be to explore the validity of the model by using data from projects which have been completed in the past and have been rated as largely successful or unsuccessful by using established criteria. Information gathered from this analysis would provide refinement to the model and determine its ability to predict on an ex post facto basis.

Phase III - Cross Validation of the Model

The primary activity in this phase would be to test the model out on projects which are currently being submitted for review and evaluation for funding or with a sample of projects which have been recently funded. Data would be secured and predictions would be made regarding project success.

Phase IV - Refinement of Model

The final phase would consist of a refinement based upon the data derived particularly from Phases II and III. Suggestions for using the model along with recommendations ragarding activities which might be undertaken to strengthen the likelihood of success based upon the model would be established.

As noted, the original objective of the proposed study was to determine if a mathematical model of educational project management could be developed. In developing the proposal, recognition was given to the possibility that the conceptual scheme would itself be further researched as well as providing a guide for future research and development activities of the Center.

The proposal was accepted by the Research Committee of the College of Education, The Ohio State University, and support provided for the period June 1970 through March 1971. The purpose of this report is to present the results of the initial phase of model development. Subsequent efforts will be devoted to validating the model and revising it as deemed necessary.

Organization of the Report

The subsequent portion of this report has been divided into

four principal sections. Section 2 presents a brief review of the nature of project management along with some early discussions of project management model development in education. Section III presents the model components as developed to this stage. Section IV presents some illustrative research studies in the area of project management.

The section dealing with project management may be omitted by the reader who is knowledgeable in this area. The reader generally unfamiliar with this concept is encouraged to read this section so that he can become better acquainted with the "reality" involved. The section on project management is not intended to be comprehensive or exhaustive in its treatment. The intent is to provide a sufficient background for adequate understanding of the model presented in Section III. A more comprehensive treatment of this topic is provided in the references.

II - THE PROJECT MANAGEMENT CONCEPT

As a concept, project management is of relatively recent origin having come into the experience and literature of management largely during the past two decades. Numerous reports and documents have been published describing its history, development, and practice. Those interested in pursuing the concept in depth beyond the comments presented here are urgued to read the writings of Archibald and Villoria (3), Baumgartner (3), Cleland and King (13), Cook (15), Keats (24), Middleton (31), Woodgate (43), Avots (6), Steiner and Ryan (40), and the Department of Defense Program Management Conference Proceedings (35). The main intent of this section is to provide an orientation to the reader not familiar with project management to the "reality" which the model attempts to represent.

Briefly defined, project management is concerned with the application of the classical management functions of planning, organizing, directing, and controlling as well as current thinking on information/decision systems to efforts which are nominally identified as <u>projects</u>. Projects are activities carried out within organizational environments and have several definitive characteristics. Prime among these are an identifiable end product which is to be accomplished with specified performance, time, and cost dimensions. Projects have a life cycle in a sense because they are conceived or born and they die or terminate. Projects are by their nature creative since they must be conceived and carried out usually with no past history to guide the effort. Thus they are fraught with uncertainty and the need for integration is paramount.

To insure that the project will be completed, the developing practice has been to identify the project as a separate entity within an organizational structure and provide it with its own leadership and resource support. Thus, the role of the project manager was formed. The project manager must produce specified results within established time, cost, and performance limitations. He must continually evaluate the project effort and make or force necessary decisions in order to make needed adjustments. He may even be forced to make recommendations for termination if the proposed objectives cannot be achieved. The project manager is usually considered the single responsible individual for the total project effort. He is involved in the creation as well as the execution of the project.

Under circumstances where projects could be self-supporting and removed from the organizational structure, problems of project management would not be great. The most typical placement of projects however within organizational arrangements creates stresses and strains which have led to the development of a study of project management as a viable means of accomplishing organizational objectives. The

project manager bearing full responsibility must work closely with existing organizational functions but often without the necessary authority to make needed decisions. Conflicts arise between authority levels and decision points which can be detrimental to the success of the project.

Out of the experience of conducting projects in established organizational settings, a new type of organizational patterning is beginning to appear - the matrix organization. In this pattern, two axes exist. One axis represents the traditional bureaucratic structure with its departments and functions. The other axis represents the projects or programs which cut across or utilize resources and skills from the functional agencies. The projects are considered as temporary systems under such an arrangement. Even though viewed as temporary, the project manager must work with existing departments to accomplish the assigned objectives.

The introduction of the project management concept as a means of accomplishing specified objectives has not been without its problems. It is not possible to state exactly when the concept began to emerge as a viable management concept and field of expertise. The study by Peck and Sherer titled The Weapons Acquisition Process (34) in the late 1950's reviewing the life history of military weapons development projects highlighted the management issues and concerns involved in efforts of a once-through nature characterized by dimensions of uncertainty. The problems were of sufficient magnitude that the Department of Defense held a conference on Program Management in 1963 (35). Many of the writers noted above have made subsequent contributions to understanding the principles and procedures or project management.

The field of education has also had its concerns with the area of project management. Many personnel have attempted to work up solutions or answers to some of the problems if not just to elucidate their existence. The Second National Study of PACE (Projects to Advance Creativity in Education) in November 1968 described a comprehensive model for managing a Title III project from conception to culmination (14). The problems involved in initiating work on a Title III project led Benningson and Nixon (10) to describe and elaborate upon the development of a project management system. The importance of a strategic approach rather than a tactical approach to project management system design was stressed by these efforts. Hanna (21) has outlined and discussed problems associated with implementing project management in a local school district. The author of this paper has attempted in his recent book titled Educational Project

Management (15) to outline the basic dimensions of a project management model or system for educational projects under the acronym PACT (Planning and Controlling Technique).

Although brief, the above discussion highlights the emergence of project management as a viable management concept and the concerns existing on the part of both non-educationally and educationally related parsons to develop better understanding of the concept through the process of developing conceptual models and/or frameworks. In developing the effort reported in this report, the work of these early and present writers has been drawn upon freely.

III - A CONCEPTUAL FRAMEWORK FOR PROJECT MANAGEMENT

Given the reality as described in Section II, there appears to be actually very little known about that set of factors or variables crucial to the management of a project or which make up the concept of project management. Various dimensions of the problem have been subjected to research efforts. Some concern has existed over the selection of projects initially with the hope that careful screening of proposals would lead to successful project execution. Baker and Pound (7) and Dean (18) have excellent reviews of research on this concern. Some concern has also existed over the nature of the project manager, his attributes and behavior (16). Some research on criteria of project success and relevant independent variables has been conducted at the Sloan School of Management at MIT under a grant from NASA in connection with a more general effort to study R and D management (27). A survey of these several investigations, however, reveals few conceptual frameworks or guides to direct the derivation of relevant variables let alone study their interrelationships. For this reason, it seemed necessary to study the reality of project management in its current state-of-the-art and abstract from such a study a set of variables or components which seem to be most crucial. In short, a model was needed. The basic question was what type of model and for what purpose?

Early in the process of working through Phase I, it became apparent that the use of the term model was inappropriate. Modeling has a rather strict definition in common usage and is concerned primarily with trying to create a replica of a reality in both structure and behavior in order that the model can be used to explain and predict what will happen in the reality if certain variables and their attributes are modified. Models can exist in a variety of forms from simple physical representations through verbal and graphical representations to mathematical formulations. It was the original intent of this study to develop a mathematical formulation or model of project management. As work progressed, this aim was considered as being premature. It became more useful and less restrictive to talk about a conceptual framework of project management. The term conceptual framework therefore has been employed in subsequent remarks in place of the concept of model. As research on the conceptual framework progresses, the development of a mathematical model in the true sense of the term still remains as a highly desirable end product.

The purpose of this section is to present the conceptual framework of project management as currently envisioned. It represents the termination of the first phase as described in Section I of the report. To present the framework, this section is divided into three parts. The first part states the intended purpose or function of the

framework. The second part describes the components and dimensions and discusses possible relationships between them. The third part states assumptions germane to the conceptual framework.

Purposes

Ashby (5) states that the first question to be dealt with in modeling is, What does one want the model to do? If there is a map to be drawn one needs to know a map of what for what purpose? Unless one can establish a purpose then it becomes difficult to know what should be included in the map or model or even its form. The same statement applies equally well to the conceptual framework.

At present, two stated purposes are considered to exist for the framework. These two purposes are not considered to be mutually exclusive, contradictory, or in conflict. Nor are they viewed as a case of suboptimization. The two purposes are as follows:

1. To identify that set of variables most directly associated with project management effectiveness or, alternatively, the successful completion of a project within a stated set of success criteria.

2. To serve as a vehicle for a program of research and development devoted to the creation of theory and knowledge regarding the concept of project management as it operates in the field of education.

The relationship between the two purposes takes a form of an hypothesis that the conceptual framework can be used to direct research and development efforts to know more about project management then it would be possible to do without such a guide.

Given the purposes as stated, the research effort would be directed toward validating the conceptual framework at both macro- and micro- levels. The macro-level would involve answering the question, Do we have all of the variables?; while the micro-level would deal with the question, Which ones are important? Research conducted through the framework might point out, for example, that the variables relating to the project creation process are more significant than are execution variables in achieving project success. If true, such a finding would point up the need for effective training of educational personnel in the task of project creation.

It is further hoped that by establishing some form of boundary around the area of concern, a useful map of the area can be drawn, the needs and problems better identified, and the priorities for research and development efforts established.

Conceptual Framework and Interrelationships

The initial development of a conceptual framework, like a model, requires that the investigator include all variables which seem or appear to be relevant then proceed to eliminate those which are not useful. Further, attention must be paid to those variables which are controllable and those which are uncontrollable. Control here means that the variable is in one's own life space and about which something can be done or changed. Uncontrollable here means that it is variable in the environment or in a space that one cannot do anything about. While not being able to do anything about the variable, attention must be paid to it since it can and does have an effect upon those variables over which one has control. Project management response to this uncontrollable influence can be viewed as an intervening variable. This division means that boundary lines are established, albeit arbitrarily in some cases, for early organization of variables. The process of establishing a boundary in this manner is consistent with general systems theory and the process of modeling. It recognizes that the process of developing a conceptual framework is a dynamic rather than a static operation. In developing the framework, certain variables are identified which are best considered as a chunk of smaller variables. That is, the particular variable includes a subset of variables which cannot be elaborated upon or which are more conveniently grouped together for descriptive purposes at this time.

The conceptual framework for project management as presently conceived and structured is presented in Figure 1 on page 12 of this report. Inspection of this graphical presentation reveals two major groupings of variables--those which are project-related and those which are environment-related. For convenience in presentation, those variables or chunks of variables which can be considered as being controlled or varied in order to insure successful completion of the project are identified with solid lines. Variables over which there is no control to produce successful completion of the project are identified with dotted lines. Each of the identified variables or components is presented below.

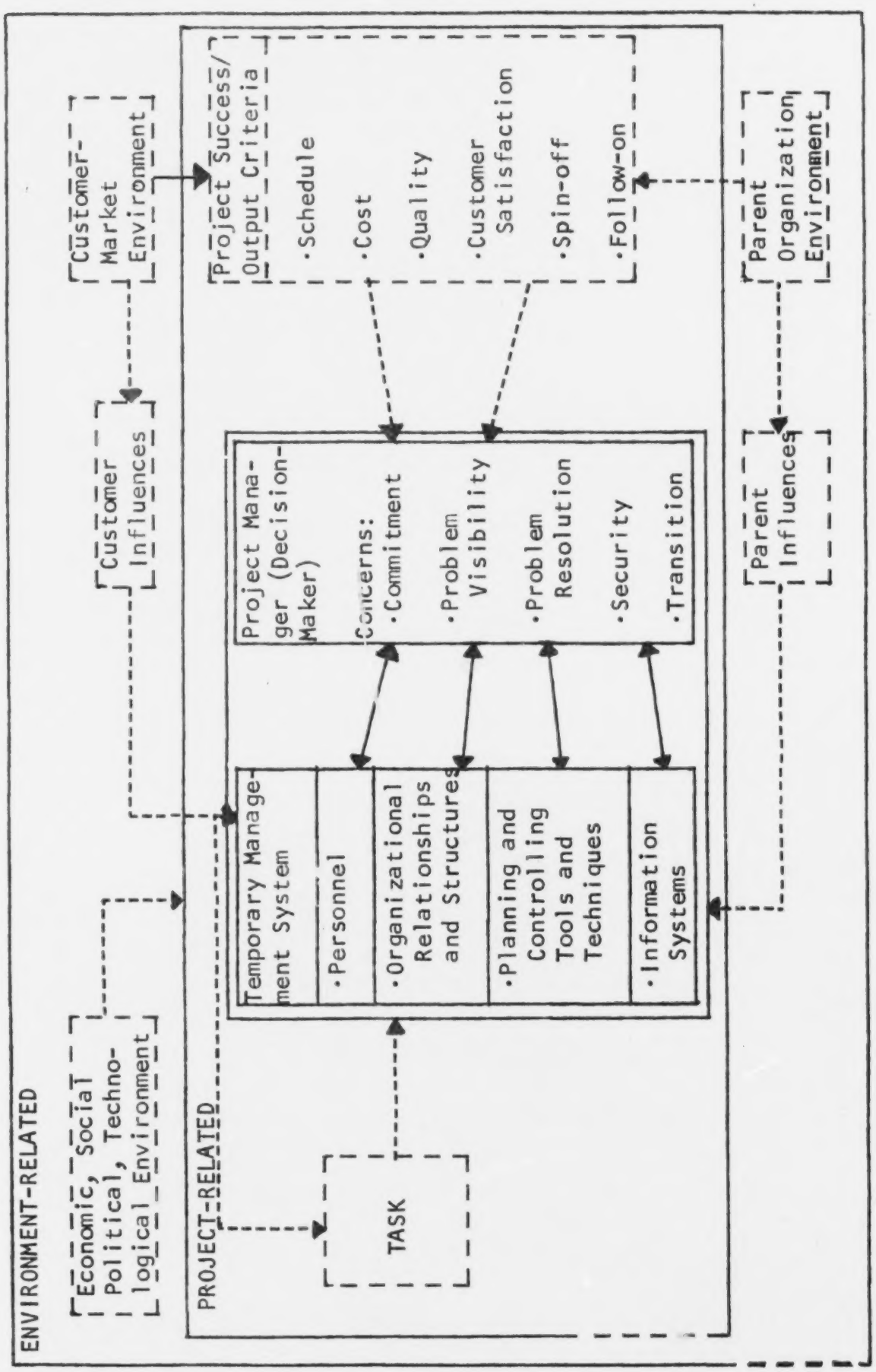

FIGURE 1 - CONCEPTUAL FRAMEWORK FOR PROJECT MANAGEMENT

Project-Related Variables. The general domain labeled Project-Related in Figure I is viewed as consisting of four principal components. Two of these are considered controllable while two are not. The controllable components are presented first followed by the uncontrollable components.

Temporary Management System One of the two controllable components is derived from assumption that a project operation is different than the normal organizational operation from a management viewpoint. In the case of the project, the management system established to achieve the goals is best considered as being temporary in nature.* In contrast, most management systems set up for normal organizational operations are considered as being relatively stable and permanent.

The temporary management system is considered as being made up of four lesser sets of variables. One set of variables relates to personnel or people who work on the project. This set involves the experience of the personnel, their visibility as a project effort, their commitment to the project effort, the authority provided to them, and the job security provided by the project situation. The second set relates to organizational relationships and structures. Here, interest is in the project organizational structure and the integration of the personnel to achieve the goals of the project. It does not include relationships between the project and its parent organization since these relationships can be modified or changed very little by the project. The main concern is with the internal integration of the effort. The third set involves the techniques and tools employed to assist in the management of the project. It is concerned also with their presence or absence as well as nature and type. Tools and techniques here includes devices for planning and controlling such as PERT, Gantt charts, Critical Path Method (CPM), or other schemes designed to help lay out the tasks, schedules, resource requirements, and related project requirements. The fourth component of information systems recognizes the need of the project manager to have necessary information to make the decisions required in the creation and execution of the project. This variable derives from current applications of information-decision theory and systems in the management of any enterprise.

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*For a discussion of the nature of temporary systmms see M. Miles, "On Temporary Systems" in Innovation in Education (M. Miles, Ed.), Columbia University, 1964.

While identified as being separate, the four variable sets without doubt interact with each other in various ways. Combined together, they function as the temporary management system created for execution of the project.

Project Manager While some might place the project director or manager as part of the personnel set of the temporary management system, that function or role is conceived of as being a separate component in the present framework. The principal responsibility of the project manager is that of a decision maker. He must orchestrate the elements of the temporary management system in order to achieve a successful project. The crucialness of his role becomes readily apparent under this perspective and leads to it being considered as a separate component.

The project manager in carrying out his function deals with a recurring set of themes which have operational importance or which present daily operational problems.* One set is concerned with the commitment of personnel or people to the temporary task. Not only are the project personnel involved but this set also includes the parent organization as well as the customer. A second set is concerned with problem visibility or project status. There is concern here with getting visible the important information with regard to problems and how to sort them out. In short, how can the project manager identify the problems in the project. A third set deals with problem resolution or the ability to solve the problems once identified. Interest here is in the ability to fix responsibility for the problem and its correction. Questions relating to where, who, when and what can be done are related to this area. It involves the project manager's ability to identify the individual(s) who have or are creating problems in project movement. The fourth set involves the security provisions existing in the staff. How can he secure commitment if the personnel are to be released upon completion of the project. This set relates to the fifth concern area which involves the transition of the project either in terms of phasing it out completely or making a transition to a permanent place into the organizational structure.

As is shown in Figure I, the success criteria impinge upon the project manager. He can do nothing about really changing the standards by which he will be considered as being successful. He might

*The author is indebted to Dr. Benningson for outlining this set of concerns.

have personal standards but his work will be judged largely by the criteria and standards set independently and largely under the influence of the customer and the parent organization.

Project Success/Output Criteria As noted, the project manager must orchestrate the elements of the temporary management system in order to accomplish the project. A major question becomes, When is the project successful? The presence of this question lead to the development of a component relating to this area.

As presently conceived, this component indentifies several criteria which might operate independently or together in fashion to ascertain if the project was successful. Schedule success refers to completion of the project within the time limits established by the project contract. It could be measured by the percent of tasks completed on time or by ascertaining if the terminal date was maintained. Cost refers largely to budgeting and associates success with remaining within the proposed dollar cost for the effort. Cost over- and under-runs become important here. Quality refers to the performance dimension and attempts to determine if the objectives were achieved in terms of the standards or specifications set for products or processes. Customer satisfaction attempts to determine the degree to which the client or customer funding the project effort is satisfied with the effort results. Spin-off focuses upon the often residual effects of a project effort. Improved personnel skills acquired during the project effort which can be applied to other areas of the organization are part of this criteria. In addition, it would include new products and processes as well as skills. Follow-on refers to the extent to which agencies directly involved in the project are willing to fund additional efforts but which would not necessarily be due to a simple continuation of a particular effort. For example, a field test of prototype instructional package would not be considered here as follow-on but a new and different project effort caused by satisfaction with the capability of the current project effort would be included.

At present, the variables in the project success component are considered to be independent of each other and equally weighted. It is not unreasonable to believe that the six variables could be restructured into three sets. One set would be related to successful use of the resources of time and dollars. A second set would be related to the customer and would include quality and performance plus customer satisfaction. A third set might incorporate the variables of spin-off, follow-on, and related aspects of building institutional resources and new technologies. While considering

the variables as independent and equally weighted, no attempt has been made to establish any order of importance or to rank them.

The several variables operate as constraints upon the project manager as he attempts to complete the effort. That is, he must consider these success criteria but cannot do much about them. He cannot, for example, change his budget at will. Requisition of additional resources from the customer or parent organization can be done but they may not be supplied so he has to complete the effort with existing dollars. It is even possible to conceive of a situation where the project is completed on time, within budget, and of required quality control but the customer is not satisfied with the result because of conflicts developing during the project. While in one sense successful, the project manager won the battle but may have lost the war.

Task At first thought, it would appear that the task assigned to the project staff and its manager to complete would be largely one that was controllable. In most cases, however, the project task is not one which the project manager or the temporary management system has much to say. The task is usually assigned to the project team to carry out. There are cases where the team might formulate the task and therefore could have some control over it but such situations are more the exception than the rule. A more common situation would exist where a planning team or office is set up to secure the contract but is disbanded upon the completion of that effort. A new team is then created to carry out the funded effort.

A breakout of variables within this larger variable has not been fully explicated at this writing. As viewed now, some of the possible subvariables are listed below:

a. Type of project (research, development, diffusion, evaluation)

b. Relative size and complexity in terms of number of tasks and personnel involved

c. Time frame (short versus long range)

d. Project life cycle or dynamics (number of changes needed to be made as project progresses)

e. Amount and nature of documentation available or the level of detail contained in the proposal

f. The uniqueness of the task to the parent organization and to the project staff

g. Degree and nature of goal and path uncertainty

h. Project creation process (team versus individual)

Regardless of the possible subvariables, the temporary management system and the project manager must accept the task and work to complete it while keeping in mind the several project success/output criteria.

Environment-Related Variables. The general nature of the environment-related variables or components of the conceptual framework consists of influences on the project which are essentially beyond the immediate control of the project manager or the temporary management system. As is considered true in general systems theory, these variables are considered to be impinging on the system boundary incorporating the project-related variables. Three major sources of influence are identified in the present framework. The first relates to the parent organization housing the project; the second to the sponsor, funding agency, or market customer who is providing the funds for project support; and the third deals with the rather general cultural conditions existing at the time the project is being carried out. Each of these three influences is examined in more detail below.

Parent Organization Environment This variable or component impinges upon the project in several dimensions. Among these factors are the parent organization's experience with projects and project management orientations in the past, the commitment of the organization to the project or project type efforts, the uniqueness of the project effort to the organizational objectives and operations of the parent group, the moral and physical support provided to the project, the degree of independence given to the project staff, the communication flow between organization and project, the degree and nature of authority provided to the project manager, the nature of the rewards to the project staff for successful completion of the project, the methods and means of recruitment and selection of personnel to work on the project, the stableness of the organization during the time of project activity, the location of the organization (rural-urban), the type of institution (public or private), and similar types of variables.

As noted in Figure I, the parent organization generates influences upon the elements of the project-related environment which are largely uncontrollable by the project manager and his management system thereby giving him concern as to their effect. Further, it is considered that the parent organization has a large influence on determining project success criteria. For example, one organization might consider success only in terms of remaining within the budget while another might judge success in terms of the spin-offs that derive from the project effort. In any case, the project manager and his staff have to be aware of what is considered successful within their parent organizational structure.

Customer-Market Environment This component relates mainly to the source of support provided to the project effort. Recognition is given to the idea that such support might be internal to the organization. Therefore, it becomes confounded with the parent organizational variable. The general position taken here is that support is considered to be external to both the project and to the parent organization. This situation occurs when the proposal is presented to a sponsor in either the solicited or unsolicited situation.

Several elements or dimensions are considered to make up this component. Among these are such factors as the customer's experience with project operations, their view of the project as an investment opportunity, their methods of selecting contractors and/or general methods of project selection, the nature and type of project visitations or on-site visits or supervision given to the project, the permanency or changing demands or specifications given to the project, their relations to the parent organization, their intentions with regard to product utilization upon completion of the effort, and similar factors.

While general comments can be directed to the customer or the agency paying the bills, this component can be expanded to include the general market in which the customer operates. Market here could be defined as the educational environment in which the customer operates. For example, the U. S. Office of Education might be a customer providing support to the project while the market might be the general education community. From an influence viewpoint, the customer might consider the project successful by its evaluation scheme but the market might not accept the product or use it since that market judges it to be of a superficial nature or unsuited to its needs.

Somewhat related to the above idea would be a condition wherein the general success criteria of the customer had been met but both the customer and the correlated market reacted negatively due to a poor general atmosphere developing in inter-project relations and, hence, would not provide further support. In this case, the project might have won a battle but lost a war.

As with the parent organization influences, the customer-market component also influences the controllable variables as well as the uncontrollable task and project success variables. The customer often has a great deal to say about the task and how it will be judged in terms of successful completion.

General Environment Lacking a better term, general has been applied to a component which consists of a larger number of environmental conditions which tend to influence the project and its operations. These can be broken down into domains such as economic, social, political, and technological environments. Within each of these domains, potential factors affecting the project could be identified.

Economic conditions might involve factors relating to the funding available for research and development efforts (actions such as Nixon's price-wage freeze) and the general nature of inflation and its effect upon project budgets. Social influences could involve factors relating to the needs and demands of society. Current discussion as to the relative importance of space flight as contrasted to social welfare problems would be an example. The political influences would involve the processes of decision-making legislative bodies which have the responsibility for allocating resources to various agencies. Advantages gained by provided moral and financial support to certain project efforts over others would be a part of this influence. The technological influences would include the availability of spin-offs from other project efforts, the availability of skilled manpower available, the types and amount of information available to the project from a varient of resources, and similar conditions.

These several influences are considered to be further removed from direct influence on the project in contrast to the customer and parent organization influences but nevertheless having an important bearing upon the several components and dimensions of the project-related variables.

Assumptions Germane to the Conceptual Framework

The development and presentation of the conceptual framework was derived under certain assumptions. It is important that these assumptions be stated so that persons other than the original developer desiring to utilize the framework can be familiar with them. This section states the several assumptions underlying the present conceptual framework.

The first assumption is that it is feasible and practical to identify the influences in the environment which can and do have an influence on the project management needs of the project.

A second assumption is that the function and operation of project management does not basically differ between public and private sectors or environments. Public sector here refers to the areas of health, education, and welfare. Private sector refers to corporate business and industrial enterprises. The public sector would also include defense-related support programs. The emphasis in the conceptual framework is given to educational settings which are represented by activities such as local school districts, state educational agencies, regional educational research and development centers, and college and university settings.

A third assumption is that the components, dimensions, and variables making up or constituting the conceptual framework can be quantified or measured on some form of nominal, ordinal, interval, or ratio scale and that interrelationships can be established among the variables.

A fourth assumption is that it is possible to determine the optimum organization of the temporary management system to meet the most effective performance relative to the success criteria.

Other assumptions will no doubt have to be made as the conceptual framework undergoes development. The assumptions set forth above represent an initial set considered in development of the present framework.

IV - SOME CURRENT RESEARCH FINDINGS

Previous sections have outlined the purpose and structure of a conceptual framework for project management in the field of education. During the course of developing the framework, several research studies focusing in on project management were encountered. This section presents some of the findings from these studies in order to provide illustrations of the nature and type of research that has been and could be carried out in order to validate the framework. The findings presented below are not meant to be an exhaustive treatment or synthesis of research on project management. Instead, they are designed to present certain findings which are already available and hence might be useful in supporting certain hypothesized relationships in the framework.

The most targeted research on project management has been that conducted under the Research Program on the Management of Science and Technology conducted under the direction of Dr. Donald P. Marquis of the Alfred P. Sloan School of Management at Massachusetts Institute of Technology (27). This research on project management was only one dimension of a larger effort started in 1962 under a financial support from the National Aeronautics and Space Administration. As a consequence, the research results presented below focus mainly from this study of project management using a sample of projects in industry and/or government agencies. In most cases, they were large scale efforts involving aerospace activities. Even though their relevance to education might not be directly transferable, the findings can suggest possible hypotheses for educational situations. For convenience, the several studies reviewed have been categorized under selected topic headings in order to provide emphasis.

Selection of Project Managers

Swanson (41) studied the decision processes used by persons charged with the responsibility of selecting project managers. He developed a model for the decision process and related it to the steps in overall project development. One of the more interesting findings was the project manager could not properly be chosen before the project was defined. It was considered important to be sure that the prospective project manager understood the area of the project. The findings also indicated that the decision process was rather implicit and judgment was a primary factor in final selection. A list of desirable attributes was developed by Swanson from the comments provided by persons charged with project manager selection. The list of attributes is presented below.

1. Sufficient technical skill in the major field of interest in the project

2. A sufficiently broad technical ability and background to be adequately conversant with all of the technical disciplines involved in the project

3. Experience in negotiation and administration of contracts

4. Can establish a team effort through abilities to work with people, command respect, and establish espirit de corps and enthusiasm

5. Can communicate ideas and delegate responsibility for execution of ideas

6. A good judge of people and can properly utilize and weigh expert opinion.

7. Possess agressiveness and drive

8. Can properly plan the work of both himself and others

9. Can properly assess and coordinate various requirements in broad areas of activity.

10. Can make timely decisions and establish proper balance between thought and action.

In presenting the list of attributes, Swanson considers them to be a minimum list rather than a maximum list. Different projects would require different weighing of these attributes but all would be required in some degree.

Success Criterion

Marquis (28) and Marquis and Straight (30) report on the development of a criterion for rating project success or performance. This was done by asking a group of experts including persons such as a laboratory manager, a project manager, a government monitor, and a contract administrator to rate project dimensions in terms of importance. The dimensions rated were technical performance, schedules, and costs. Based upon the judgment of experts, technical performance was considered to have the highest weighting followed by schedules and costs with lesser emphasis.

Project Performance and Selected Project Factors

Using the performance criterion developed and described in the above paragraph, several studies were conducted in which various project characteristics and project manager factors were studied. The basic format of these studies was largely of a relationship nature in which selected variables were correlated with ratings obtained by experts on the performance or success of the project.

Rubin (37) investigated several factors and the general findings of his study are presented below.

1. The number of full-time professionals employed on a project was positively related to the internal priority given to the project.

2. Large-scale projects were given high levels of priority in organizational structure.

3. High priority large-scale projects were assigned older and more experienced project managers.

4. Project managers selected for sole source as contrasted with competitive contracts had significantly less project management experience than did project managers selected for competitive projects.

5. No relationship was found to exist between project type (sole source versus competitive) and size or priority of project.

6. A high relationship was found between prior project experience and years of total experience for project managers.

7. A high relationship existed between years of experience and responsibility for a project as measured by ratio of current project dollar amount to prior project dollar amount (responsibility index).

8. Responsibility index as measured by current/past dollar ratio was not related to any of the project characteristics.

Using characteristics such as priority, project manager experience, and type of project, Rubin related measures of technical performance to the

selected set. The findings observed from this portion of the study were as follows:

1. Technical performance was negatively related to amount of prior project experience on the part of the project manager.

2. Sole-source projects achieved higher levels of technical performance than did competitive projects.

3. The higher the internal order of the project the greater or better the technical performance of the project.

4. Years of total experience for the project manager was unrelated to technical performance.

5. A high responsibility index was related to technical performance on the project.

6. No relationship existed between technical performance and the project manager characteristics such as length of service with company or time from first baccalaureate degree to first supervisory job.

In a similar study Rubin and Marquis (38) combined to investigate several additional factors as they might relate to project technical performance. Using procedures similar to the other studies, the following findings were obtained.

1. Sole-source contracts do better in technical performance than competitive projects.

2. The less effort in the total project that was sub-contracted the better the technical performance.

3. The inclusion of a safety factor (fudge factor or slack) in time and cost in the initial estimates was positively related to high technical performance.

4. A high absolute number of key people and a large number chosen on basis of specialized talent was associated with high technical performance.

5. No restrictions on the choice of sub-contractors were associated with poor technical performance than was the case when restrictions were applied.

Marquis (28) summarized much of the current findings conducted under the NASA-sponsored program in a recent article in the new magazine Innovation. He reports a summary of six factors and their possible influence on project performance. Some of the factors were previously reported in articles by Rubin and Rubin and Marquis, but additional ones were reported in the Marquis article. Among the findings reported and discussed were the following.

1. Functional organization of technical personnel was positively related to technical performance while functional organization of administrative personnel was not influential.

2. Complete project teams including both technical and administrative personnel were associated with lower technical performance but more likely to meet established cost and schedule deadlines.

3. No relation was found to exist between the formal authority of the project manager and the actual success of the project.

4. No significant differences were observed between projects which used PERT and those which did not with regard to technical performance.

In addition to the types of empirical research represented by the work of Rubin and Marquis, interview-type studies were made as noted in the case of Swanson above and that reported by Osborne (33) Osborne interviewed project managers, support managers, and persons having prime responsibility for projects in five major concerns and three government organizations developing weapons systems. From this series of interviews, he identified five major factors which appear to be relevant to project success. These five factors were as follows.

1. The characteristics of the original proposal and the methodology of its development

2. The level of responsibility given to the project, its placement in the organizational structure, and the degree of authority provided the project manager

3. The staffing or selection, acquisition, and motivation of project personnel

4. The fractionalization of work or the division of work, the assignment of tasks, identification of problem areas, progress evaluation, and related task assignments

5. The establishment of adequate project controls for the determination of physical accomplishment and program costs including schedules, contract administration, office management, and related ideas

In addition to the above studies, the author has undertaken research to determine the duties and responsibilities of project managers in educational settings (16). Using a sample of project managers, project evaluators, and educational project auditors, each was given a list of duties and responsibilities and requested to check if they did actually perform the duty or if they felt they should perform the duties. The findings indicated that the actual duties focused around concerns over administrative detail and housekeeping matters. Agreement was made with idealized behavior that should be exhibited by the project manager.

Summary

As stated above, the previously mentioned studies indicate that some research is already available with regard to the relationship between components and dimensions of a conceptual framework for project management. The development of the framework into its present form can lead to generation of hypotheses which can be subjected to similar types of empirical tests in order to validate the framework.

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